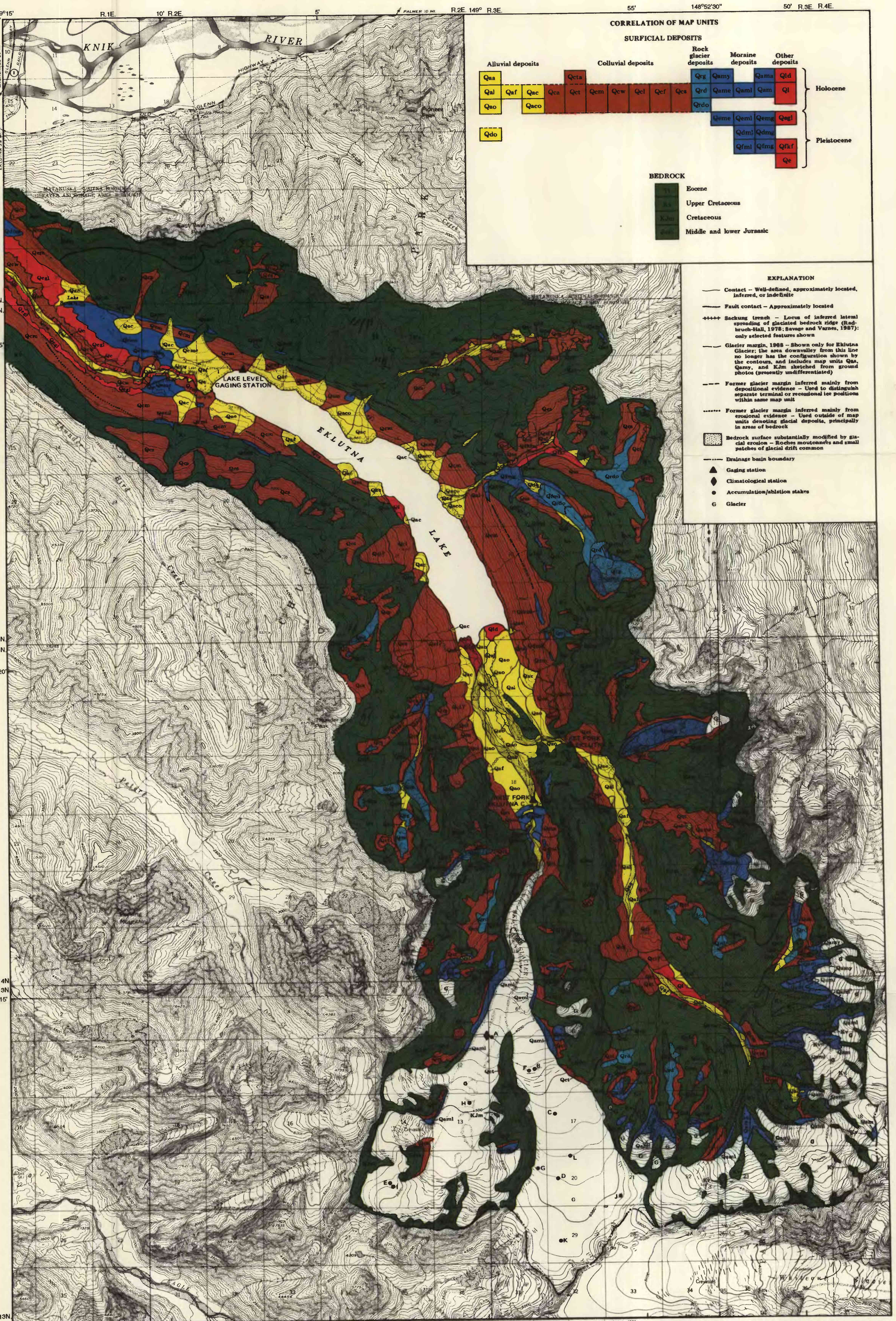
Prepared in cooperation with the
MUNICIPALITY OF ANCHORAGE



Base from U.S. Geological Survey
Anchorage (A-5)(A-6)(B-5)(B-6), Alaska
1:63,360, 1960

APPROXIMATE MEAN DECLINATION, 1960

SCALE 1:63 360

CONTOUR INTERVAL 100 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Surficial geology mapped by H.R. Schmoll and Ernest Dobrovolny, 1965-1971, by interpretation of 1:40,000-scale airphotos taken in 1957 and by field investigations. Additional field investigations by H.R. Schmoll in 1973 and 1988. Bedrock mapping modified from Clark and Bartsch, 1971; Clark and Yount, 1972; Clark, 1972; and Updike and Ulery, 1983

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Alluvial Deposits

Chiefly gravel and sand deposited by moderate and small streams. Generally well bedded and sorted, clasts commonly well rounded. Thickness variable, probably a few to several meters, thickest in larger valleys

Qaa **Alluvial deposits in active flood plains (latest Holocene)**--Intermittently in the transport mode, deposited temporarily in bars which commonly change their position along braided and single channels. Vegetation cover generally absent

Qal **Alluvial deposits along modern streams and in lowest terraces (Holocene)**--Generally at or no more than a few meters above stream level. Includes narrow active flood plains where too small to map separately

Qao **Outwash deposits related to Alaskan moraines (Holocene)**--Generally in small plains distal to moraines and in terraces a few meters above present stream level

Qdo **Outwash deposits possibly related to Dishno Pond moraines (late Pleistocene)**--Occur only in tributary valley northeast of Eklutna Lake; age relationship uncertain

Qaf **Alluvial-fan deposits (Holocene)**--In fans of relatively low gradient graded to or just above modern stream level; streams generally have narrow active flood plains not mapped separately and may change course within fan

Qac **Alluvial-cone deposits (Holocene)**--Similar to alluvial-fan deposits but more poorly sorted and containing a higher proportion of angular clasts; gradients steeper

Qaco **Older alluvial-cone deposits (Holocene)**--Graded to higher levels than younger cones and less subject to activity of modern stream

Colluvial Deposits (Holocene and Late Pleistocene)

Colluvial deposits are those that occur on slopes and that have accumulated primarily by the action of gravity and secondarily by running water. They include both (1) deposits that have accumulated particle by particle over a long period of time and that underlie commonly smooth slopes, and (2) deposits that have moved en masse either slowly, such as by creep, or rapidly, such as by debris avalanching, and that commonly are characterized by slopes that are irregularly lumpy to hummocky. Thicknesses poorly known and highly variable, generally thickest in middle to lower reaches of slopes

Qca **Colluvio-alluvial apron deposits on valley walls**--A mixture of colluvium and alluvium similar to that in map unit Qac but in deposits too small to map separately. Include both loose, sandy to rubbly diamicton and poorly sorted sand and gravel, as well as some organic material. Bedrock may be encountered in shallow excavations and crop out at scattered localities, especially in the upslope part of the map-unit area and in gullies

Qct **Talus cones**--Cone-shaped to apronlike deposits on valley walls, generally in more rugged mountain areas. Mainly loose, angular fragments derived directly from weathering of bedrock upslope; particles range from clay to boulder size. Accumulate rapidly enough to preclude development of vegetation cover in most places

Qcta **Talus cones, abnormally active**--Activity increased to a high level following the 1964 Alaska earthquake and continued at least through 1970 (Clark and others, 1972); accumulation still is probably somewhat more active than most other cones in the region; activity, caused by unstable and highly fractured rock, may be related to sackung trench at top of mountain in T. 14 N., R. 3 E., sec. 20

Qcm **Colluvial deposits derived from moraines**--Diamicton similar to that of adjacent upslope moraines but less compact; include minor amounts of better sorted sand, silt, and gravel

Qcw **Colluvial deposits on walls of stream bluffs**--Loose accumulations derived from adjacent, upslope deposits that form a veneer on bluffs following erosion. Chiefly diamicton

Qcl **Landslide deposits**--Include a wide variety of materials, chiefly diamicton, bedrock rubble including some very large masses of unbroken rock, minor amounts of better sorted clay- to boulder-size material, and organic material that have accumulated mainly as debris avalanches and (or) more slow-moving masses; queried where identification uncertain--such areas may alternatively consist mainly of in-place bedrock and constitute "pseudo-landslides" (Shlemon and Davis, 1986)

Qcf **Earthflow deposits**--Similar to other landslide deposits but probably emplaced by massive, probably slow-moving earthflows that have clearly recognizable form; may in part be related to rock glaciers, but appear to have a more liquid rather than ice-rich medium of transport

Qcs **Solifluction deposits**--Relatively large areas of slope that appear somewhat irregular with numerous small lobes of material that have moved downslope either with the aid of interstitial ice (solifluction in a rigorous sense) or of water derived mainly from snowmelt. Include small landslide deposits that may have moved more rapidly

Rock-Glacier Deposits

Qrg **Rock glaciers (latest Holocene)**--Accumulations of mainly angular to some subrounded rock fragments still actively being transported, derived from upslope talus, landslide, or glacial deposits; contain ice-rich matrix and move very slowly downslope; surface irregular and generally lacking vegetation. Upper surface dominated by cobble- and boulder-size fragments; at depth, substantially more fine-grained material may be present to form coarse, rubbly diamicton. Thickness unknown, but probably several to a few tens of meters

Qrd **Younger rock-glacier deposits (late Holocene)**--Similar to active rock glaciers except that movement has probably ceased and some vegetation covers the somewhat smoother surface

Qrdo **Older rock-glacier deposits (Holocene and late Pleistocene)**--Similar to younger rock-glacier deposits but almost certainly not active; vegetation mat thicker and ground surface smoother than on younger deposits

Moraine Deposits

Deposited directly by glacier ice either along its margins in end and lateral moraines or beneath the main body of ice as ground moraine. Correlated with named lateral and end moraines that occur along the Chugach Mountain front southwest of the map area as described by Schmoll and Yehle (1986) and mapped by Yehle and Schmoll (1989) where well developed. The till that composes most of the moraine deposits is chiefly a diamicton consisting of massive, unsorted to poorly sorted mixtures of gravel, sand, silt, and relatively minor amounts of clay; includes scattered boulders; moderately to well compacted

End- and Lateral-Moraine Deposits

Qamy **Youngest deposits (latest Holocene)**--Formed as glaciers retreated and downwasted, probably within the last several decades; may contain ice core inherited from stagnant glacier ice

Qame **End-moraine deposits of the Alaskan glaciation (Holocene)**--Well developed in a set of moraines downvalley from Eklutna Glacier. Possibly correlative with the Tunnel advances of Karlstrom (1964)

Qaml **Lateral- and minor end-moraine deposits of the Alaskan glaciation (Holocene)**-- Mainly related to present-day glaciers or to small glaciers no longer present. Coeval with deposits of map unit Qame

Qeme **End-moraine deposits of the Elmendorf Moraine (late Pleistocene)**--Broad complex that marks downvalley limit of Eklutna valley glacier in the vicinity of Lake Barbara

Qeml **Lateral-moraine deposits of the Elmendorf Moraine (late Pleistocene)**--Extend as remnants along the walls of Eklutna valley from the end moraine deposits near Lake Barbara upvalley to about the middle of Eklutna Lake

Qdml **Lateral-moraine deposits of Dishno Pond moraines (late Pleistocene)**--Occur as remnants along the walls of Eklutna valley, more continuously preserved near the upper end of Eklutna Lake

Qfml **Lateral-moraine deposits of the Fort Richardson moraines (late Pleistocene)**--Occur only as remnants in tributary valley on northeast side of Eklutna Lake

Ground-Moraine Deposits

Qama **Ablation moraine deposits on existing glaciers (latest Holocene)**--Mainly the debris-rich lower areas of several small glaciers; includes the deposits of small medial moraines. Surface of glacier is largely covered by rubbly accumulations of angular to subrounded rock fragments of all sizes; glacier ice present at variable depth, probably a few to 10 meters

Qam **Deposits of the Alaskan glaciation (Holocene)**--Include colluviated moraine and outwash derived from existing glaciers in areas too small to map separately

Qemg **Deposits of the Elmendorf Moraine (late Pleistocene)**--Occur mainly in a few patches near the upper end of Eklutna Lake

Qdmg **Deposits of Dishno Pond moraines (late Pleistocene)**--Occur only at the west edge of map area. In the map area to the west (Yehle and Schmoll, 1987) these deposits have not been mapped separately from those of the Fort Richardson moraines, map unit Qfmg

Qfmg **Deposits of the Fort Richardson moraines (late Pleistocene)**--Occur only in a tributary valley northeast of Eklutna Lake where they probably include colluviated moraine and outwash deposits

Other Deposits

Qld **Delta deposits (late Holocene)**--Mainly gravel and sand formed and presently being deposited at the head of Eklutna Lake. Thickness probably a few tens of meters

Ql **Lake deposits (Holocene)**--Formed behind a massive landslide deposit which blocked drainage of the East Fork Eklutna valley. Probably silt and sand, with some gravel; locally includes veneer of alluvial deposits formed as the lake broke through the landslide dam. Also include deposits of a possible higher level of Eklutna Lake. Thickness poorly known, probably several meters

Qegl **Glaciolacustrine deposits (late Pleistocene)**--Mainly silt and clay, including some beds of sand, gravel, and diamicton. Two phases not divided on map: earlier phase occupied area between toe of glacier in Eklutna valley and margin of larger glacier in Knik valley to the northwest; later phase occupied lower area within complex of Elmendorf-related end-moraine deposits (Qeme) near Lake Barbara as Eklutna valley glacier retreated upvalley. Thickness about 10 meters

Qfkf **Kame-fan deposits related to the Fort Richardson moraines (late Pleistocene)**--Probably gravel and sand that is well to poorly bedded and sorted and that accumulated in alluvial fans or small lakes blocked by glacier ice; may include beds of silt, clay, and diamicton. Occur in tributary valley northeast of Eklutna Lake. Thickness poorly known, possibly as much as a few tens of meters

Qe **Eklutna deposits (Pleistocene)**--Chiefly gravel, silty sandy gravel, and gravelly diamicton of a distinctive yellowish-gray color; in part well bedded, with moderately dipping beds indicative of a source up Eklutna valley; generally rather poorly sorted. Moderately compacted and slightly indurated. May represent outwash and (or) deposition in a glacial lake in part as a delta of an older glaciation. Crop out on the inner valley walls along Eklutna River; probably underlie younger deposits mapped at the surface in Eklutna valley. Thickness as much as 40 meters in outcrop, base not exposed

BEDROCK

Descriptions of bedrock units and contacts shown on map are derived entirely from Clark and Bartsch (1971), Clark (1972), Clark and Yount (1972), and Updike and Ulery (1983); symbolization and age designations from Winkler (1992)

Rocks of the Chugach Terrane

Ti **Felsic to intermediate hypabyssal rock (Eocene)**--In dikes, sills, and small intrusive bodies

Kv **Valdez Group (upper Cretaceous)**--Predominantly metagraywacke, siltite, and argillite flysch deposits; includes some calcareous metasand- stones. Locally phyllitic

KJm **McHugh Complex (Cretaceous)**--Heterogeneous assemblage including marine metaclastic and metavolcanic rocks. Predominantly metasandstone to metaconglomeratic sandstone, commonly quartz-poor, feldspathic to lithic; may include tuffaceous material. Subordinate greenstones (including basaltic and spilitic pillow lavas) usually associated with chert, cherty argillite, and argillite

Rocks of the Peninsular Terrane

Jum **Ultramafic rocks (middle and lower Jurassic)**--Predominantly peridotite, dunite, and pyroxenite, weakly to locally strongly serpentinized

REFERENCES CITED

Clark, S.H.B., 1972, Reconnaissance bedrock geologic map of the Chugach Mountains near Anchorage, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-350, scale 1:250,000.

____1973, The McHugh Complex of south-central Alaska: U.S. Geological Survey Bulletin 1372, p D1-D11.

Clark, S.H.B., and Bartsch, S.R., 1971, Reconnaissance geologic map and geochemical analyses of stream-sediment and rock samples of the Anchorage B-6 quadrangle, Alaska: U.S. Geological Survey open-file report, 63 p., scale 1:63,360.

Clark, S.H.B., Foster, H.L., and Bartsch, S.R., 1972, Growth of a talus cone in the western Chugach Mountains, Alaska: Geological Society of America Bulletin, v. 83, no. 1., p. 227-230.

Clark, S.H.B., and Yount, M.E., 1972, Reconnaissance geologic map and geochemical analyses of stream-sediment and rock samples of the Anchorage A-6 quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-351, scale 1:63,360.

Karlstrom, T.N.V., 1964, Quaternary geology of the Kenai Lowland and glacial history of the Cook Inlet region, Alaska: U.S. Geological Survey Professional Paper 443, 69 p.

Radbruch-Hall, D.H., 1978, Gravitational creep of rock masses on slope, in Voight, Barry, ed., Rockslides and avalanches, v. 1, Natural phenomena: Amsterdam, Elsevier, p. 607-657.

Savage, W.Z., and Varnes, D.J., 1987, Mechanics of gravitational spreading of steep-sided ridges ("sackung"): International Association of Engineering Geology Bulletin, no. 35, p. 31-36.

Schmoll, H.R., and Yehle, L.A., 1986, Pleistocene glaciation of the upper Cook Inlet basin, in Hamilton, T.D., Reed, K.M., and Thorson, R.M., eds., Glaciation in Alaska--the geologic record: Anchorage, Alaska Geological Society, p. 193-218.

Shlemon, R.J., and Davis, Paul, 1986, Engineering-geological implications of pseudo-landslides in an urbanizing area, San Juan Capistrano, California: Proceedings, Fifth International Congress, International Association of Engineering Geology, Buenos Aires, Argentina, October 20-25, 1986, v. 6, p. 2011-2016.

Updike, R.G., and Ulery, C.A., 1983, Preliminary geologic map of the Anchorage B-6 NW (Eklutna Lake) quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Report of Investigations 83-8, scale 1:10,000.

Winkler, G.R., 1992, Geologic map and summary chronology of the Anchorage 1° x 3° quadrangle, southern Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-2283, scale 1:250,000.

Yehle, L.A., and Schmoll, H.R., 1987, Surficial geologic map of the Anchorage B-7 NE quadrangle, Alaska: U.S. Geological Survey Open-File Report 87-416, 20 p., scale 1:25,000.

____1989, Surficial geologic map of the Anchorage B-7 SW quadrangle, Alaska: U.S. Geological Survey Open-File Report 89-318, scale 1:250,000.

MAP SHOWING GEOLOGY AND LOCATION OF HYDROLOGIC DATA SITES IN THE EKLUTNA LAKE DRAINAGE BASIN, SOUTHCENTRAL ALASKA